

### ***Remarks/Arguments***

Claims 1-3, 7-12, 14, 17-22, and 36-44 of the application were rejected and remain for consideration by the Examiner. Claims 23-32 and 36-38 were objected to and would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. Claims 4-6, 13, 15, 16, and 33-35 were previously withdrawn from consideration by the Examiner as drawn to nonelected species. The Examiner previously agreed with Applicants' previous arguments that claim 1 is generic with respect to claims 1-42 and claim 39 is generic with respect to claims 40-42.

Claims 1 and 43 are amended to include a boiling enhancement structure, which is the subject matter of canceled claim 7.

Claims 8 and 11 are revised to be dependent from claim 1 rather than canceled claim 7.

Claim 41 is amended to correct a typographical error.

It is respectfully submitted that none of the references, individually or in combination, disclose or suggest a thermosyphon having independence from orientation.

### ***Claim Rejections – 35 USC § 102 – Andres et al.***

The Examiner rejected claims 1, 39, 41, and 43 under 35 U.S.C. § 102(b) as anticipated by Andres et al., US Patent No. 4,550,774 ("Andres"). The Examiner recited each element of each claim and indicated that each element was disclosed in Andres. In order to anticipate a claim, the reference must disclose all elements of the claim.

As amended herein, claims 1 and 43 respectively include a boiling enhancement structure and providing a thermosyphon including a boiling enhancement structure. Andres does not disclose such a structure, and accordingly Andres cannot anticipate claims 1 or 43. Nor is the recited combination of elements obvious based on Andres in view of any other cited reference, as will be discussed below under § 103 rejections (claim 7 – Andres in view of Ghoshal).

Claims 39 and 41 conclude with the clause “wherein thermosyphon performance is substantially independent of thermosyphon orientation.” The Examiner cites Andres at column 1 lines 43-47 for such a disclosure. The Applicants respectfully submit that the cited text of Andres, where it is stated that “the present invention is independent of gravitational and inertial forces,” is not equivalent to the condition recited in claims 39 and 41. Andres, rather, is directed to a near horizontal installation that is alleged to be helpful for motor vehicles, aircraft, or ships that must deal with inclinations, acceleration, and deceleration (column 1 lines 22-28). The Applicants’ invention, however, operates over a much greater range of orientation – namely, performance is substantially independent of *any* orientation. One example of this difference is when the devices are inverted (upside down). In that case, the Applicants’ invention (for example, Figure 8) operates substantially the same as it does when right-side-up (Figure 3) with the evaporator substantially full or full, but Andres’ condensate collector (Figure 8) would be empty or near empty, with performance therefore significantly impaired. Performance results would likewise be similar in the case where the devices are vertically oriented, with the Applicants’ invention (for example, Figures 6 and 7) performing similarly to

when it is horizontal and Andres' performance impaired. Accordingly, Andres' performance is not disclosed or taught to be substantially independent of orientation, and claims 39 and 41 are nonobvious.

***Claim Rejections – 35 USC § 103 – Andres in view of Ghoshal***

The Examiner rejected claims 2, 3, 7, 12, 17 through 25, 32, 40, and 42 under 35 U.S.C. 103(a) as being obvious with respect to Andres in view of Ghoshal US Patent No. 6,474,074 (Ghoshal). These claims are nonobvious in that there is no *prima facie* case of obviousness.

The Examiner first refers to claims 2, 3, 17 through 22, 25, 32, 40, and 42 as being disclosed by Andres with the exception of cooling means that comprise cooling fins extending from the condenser. It is respectfully submitted that this rejection applies only to claims 2 and 3, which respectively recite cooling fins and cooling fins that extend from the condenser. The remaining referenced claims (17 through 22, 25, 32, 40, and 42) relate to coolant levels within the device, and therefore the cooling fins of Ghoshal are inapposite.

With respect to claims 2 and 3, these claims depend either directly or indirectly from allowable claim 1, incorporating the limitations thereof, and are therefore allowable as well.

Referring to canceled claim 7 that includes the element of a boiling enhancement structure, which has been incorporated into amended claim 1 and claim 43, it is respectfully submitted that the Examiner is in error by stating that Ghoshal provides a

boiling enhancement structure. The boiling enhancement structure of the Applicants' invention is "a porous component that provides re-entrant cavities" (p. 10, lines 20-21). Neither Andres nor Ghoshal teach or suggest such a claim limitation.

Ghoshal has "hot point" elements 250, which are disclosed as conically shaped (see col. 4, lines 9-15). Alternatively, they may be pyramidal, or any shape terminating at a tapered point (col. 4, lines 31-37), and are so required in order to function in accordance with Ghoshal's invention. *"Any configuration may be used as long as the hot points terminate at a tapered point"* (col. 4, lines 34-36; emphasis added; see also Ghoshal independent claims 1, 21, and 29, all requiring hot point elements). The Ghoshal hot point elements are structurally and functionally different from Applicants' boiling enhancement structure. As neither Andres nor Ghoshal have a boiling enhancement structure, the combined references do not include every element of Applicants' invention, and there is no *prima facie* case of obviousness.

Andres is a capillary-driven device, in that it is a heat pipe (col. 1, lines 29-44; col. 2, lines 63-68; see also the claims). Likewise, Ghoshal is a heat pipe and is capillary-driven (col. 1, lines 57-59; col. 2, lines 37-48; col. 2, line 62 through col. 3, line 2; col. 3, lines 34-37; col. 4, lines 37-45; see also the claims). The evaporation process of Andres and Ghoshal is a surface phenomenon and does not involve the formation of vapor bubbles that form in Applicants' invention. This is one reason why there needs to be only a thin layer of liquid, for example, in the evaporator section of Ghoshal's device for it to function properly. Excess liquid at high heat fluxes would result in bubble formation that might block the capillaries and prevent the return of liquid from the con-

denser to the evaporator, known as the "boiling limit" in heat pipes, and needs to be avoided in Ghoshal. As both Andres and Ghoshal are capillary-driven, there can be no expectation of success in their combination to achieve a device that involves vapor bubble formation. In addition to the lack of a likelihood of success in modifying Andres in view of Ghoshal there is also no suggestion to modify or combine the teachings.

There being no *prima facie* case of obviousness, amended claims 1 and 43 are nonobvious with respect to Andres in view of Ghoshal.

Claim 12 is directed to the central evaporator, which is defined as having first and second spaced plates. Claim 12 depends from allowable claim 1, and respectively adds limitations thereto, and is therefore allowable. In addition, claim 12 is not obvious based on Andres in view of Ghoshal because, as discussed above, Andres and Ghoshal cannot be combined because there is no likelihood of success in doing so or suggestion or motivation to combine the references.

The Applicants will address claims 17 through 22, 25, 32, 40, and 42, which all relate to coolant levels at various thermosyphon orientations, based on Andres in view of Ghoshal. These claims depend either directly or indirectly from allowable claims 1, 39, or 41, incorporating the limitations thereof, and are therefore allowable as well, in addition to the following reasons.

As previously discussed with respect to Andres under the § 102 rejection rebuttal above, the performance of Andres is not substantially independent of orientation. Likewise, Ghoshal is not orientation independent. Ghoshal cannot be combined with Andres to result in a substantially full evaporator at any orientation. Contrary to the Ex-

aminer's statement, coolant *cannot* fill the evaporator of Ghoshal. The liquid coolant, or transport fluid, of Ghoshal can only partially fill the Ghoshal evaporator based on Ghoshal's operating principles. Ghoshal teaches away from a substantially full evaporator by requiring that there be vapor in the evaporator region, which is transported by the vapor channels 235 (col. 4, lines 38-41). Nor can Ghoshal function at any other orientation than right-side-up and nearly horizontal (Figures 2 and 3).

Ghoshal would not function if the transport fluid substantially filled the evaporator region; if it did, not only would there be no void available for vapor in the evaporator, but the condenser region would also be substantially full of transport fluid. Ghoshal's Figure 2 does not show *any* fluid in between its first and second substrates 230, 240. Presumably, Ghoshal's evaporator does include some fluid. As discussed above, however, with respect to claim 7 and amended claims 1 and 43, the liquid coolant, or transport fluid, of Ghoshal only is present in the evaporator in a thin layer, and Ghoshal does not teach or suggest a substantially full evaporator in any orientation. Ghoshal would not function if the transport fluid filled the evaporator region; if it did, not only would there be no void available for vapor in the evaporator, but the condenser region would also be full of transport fluid. Ghoshal lacks the ability to have a full evaporator region, and accordingly would be rendered unsatisfactory for its intended purpose if its evaporator were full. There is no *prima facie* case of obviousness with respect to the combination of Andres and Ghoshal.

***Claim Rejections – 35 USC § 103 – Andres in view of Anderson et al.***

The Examiner rejected claims 8-11, 18-22, 40, and 42 under 35 U.S.C. § 103(a) as obvious based on Andres in view of Anderson et al. US Patent No. 5,761,037 (Anderson). The Examiner specifically discusses only claims 8-11, which relate to a boiling enhancement structure; it is respectfully submitted that claims 18-22, 40, and 42 do not apply to boiling enhancement structures or to Anderson. Instead, these claims relate to levels of coolant in various orientations of a thermosyphon. For the reasons discussed above with respect to claims 17 through 22, 25, 32, 40, and 42, claims 18-22, 40, and 42 are nonobvious and are allowable, as well as reasons set forth below.

First, with respect to claim 8, which is directed to a boiling enhancement structure including a plate with parallel grooves, Anderson's wicking manifold 102 is used to spread liquid in the evaporator, and is purportedly able to do this at any orientation. Applicants' structure, however, is used mainly for trapping vapor to provide active nucleation sites for boiling, and is not used to ensure orientation independent performance of the thermosyphon heat spreader. There is no suggestion in either Andres or Anderson to combine Anderson's structure for spreading liquid to make a site for vapor nucleation. Further, claims 8-11 depend either directly or indirectly from allowable claim 1, and respectively add limitations thereto, and are therefore allowable.

Next, with respect to claims 18-22, 40, and 42 and Andres, as stated above in the rebuttal of the § 102 rejection of claims 39 and 41, Andres is directed to a near horizontal installation that is alleged to be helpful for motor vehicles, aircraft, or ships that must deal with inclinations, acceleration, and deceleration (column 1 lines 22-28). The

Applicants' invention operates over a greater range of orientation – namely, performance is substantially independent of *any* orientation. Coolant levels substantially or completely fill the Applicants' evaporator from when it is horizontal and right side up through vertically oriented (Figures 6, 7, 9-15, claims 18 and 19), all orientations (claims 20 and 22), and right side up and upside down (claims 21, 40, and 42). Accordingly, Andres, or Andres in view of Anderson, does not disclose, teach, or include the characteristic of a substantially or completely full evaporator at any orientation. Further, these claims depend either directly or indirectly from allowable claims 1, 39, or 41, incorporating the limitations thereof, and are therefore allowable as well.

***Claim Rejections – 35 USC § 103 – Andres in view of Paal***

Claim 14 is directed to a second evaporator plate formed with at least a part of the heat-dissipating component from a single piece of material. The Examiner rejected claim 14 as obvious under 35 U.S.C. § 103(a) based on Andres in view of Paal US Patent No. 5,051,814 (Paal). Claim 14 is allowable as it depends from allowable claim 12, which depends from allowable claim 1, and adds limitations thereto.

***Claim Rejections – 35 USC § 103 – Andres in view of Larson***

Claim 44 is directed to providing a void in the evaporator to allow coolant to directly contact the heat-dissipating element. The Examiner rejected claim 44 under 35 U.S.C. § 103(a) based on Andres in view of Larson et al. US Patent No. 5,704,416 (Larson). The Examiner stated that Andres discloses Applicants' invention except for providing a void in the evaporator to allow coolant to directly contact the heat-dissipating element. The Examiner asserts that Larson discloses this exception. It is



respectfully submitted that the Examiner was incorrect in this assertion. The portion of the specification of Larson cited by the Examiner does not mention such a feature (column 8 lines 38-47); the cited text in Larson merely teaches use of a clip to fasten a chip to an evaporator. Claim 44 is nonobvious as the references do not teach or suggest all of the claim elements, and further do not suggest or provide motivation to modify the substrate.

***Allowable Subject Matter***

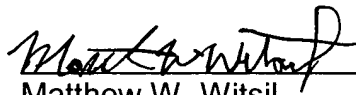
The Applicants appreciate the Examiner's acknowledgement of claims 23-32 and 36-38 as being allowable if rewritten in independent form including all of the limitations of the base claim, including claim 1 as previously presented, and any intervening claims.

If the Examiner has any questions about the present Reply, a telephone interview is respectfully requested.

As the rejections entered by the Examiner in the Official Action dated March 21, 2005 have been shown to be inapplicable, reconsideration and allowance of claims 1-3, 7-12, 14, 17-22, 33-35, and 39-44, and passage of these claims to issue, is hereby respectfully requested. Further, as the Examiner previously agreed that allowable claim 1 is generic with respect to claims 1-42 and allowable claim 39 is generic with respect to claims 40-42, it is requested that the withdrawn claims be reconsidered and passed to issue.

Respectfully submitted,

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